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10-19-2009

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Recommended Citation
Hurburgh, Charles R. and Peterson, Palle, "Soybean Quality Issues in 2009" (2009). *Integrated Crop Management News*. Paper 531.
http://lib.dr.iastate.edu/cropnews/531

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Soybean Quality Issues in 2009

By Charles Hurburgh, Department of Agricultural and Biosystems Engineering; Palle Pedersen, Department of Agronomy

After a warm period in early September, crop maturity was slowed by rain, and in some areas snow. The state experienced a hard freeze on Oct. 10 and 11. Despite the overall cool growing season, the USDA October Iowa yield estimate was the highest on record. As often happens with high grain yields, quality issues are surfacing.

Current conditions

The quick burst of heat in September moved many soybeans, especially in the western half of the state, to maturity, but at the further expense of some grain fill and composition. As in 2008, soybean protein contents are low (31-34 percent typically) and oil contents above average (19 percent or greater). This will produce high-protein meals in the 45-47 percent protein range, although normally the essential amino acids (lysine, methionine and cysteine) do not fall off as rapidly as protein, leading to potentially good nutritional value for swine and poultry.

In the western half of Iowa, soybeans were generally mature before the frost, but intermittent rain and snow hampered harvest progress. Soybeans in the field that have dried down once then regained moisture will dry again at least once. Soybeans are very responsive to air relative humidity. However, after Oct. 20, the number of low humidity warm days decreases and therefore the field drydown chances decrease. If the ground is cold and damp, the environment around the plants will not be conducive to drying. Soybeans if left in the field generally settle between 17 and 20 percent moisture. Moisture meters can read mature wet beans accurately. Check farm meters against state inspected elevator meters on 5-10 samples.

Some soybeans were frost-damaged in eastern Iowa. Frost Damage to Corn and Soybeans, PM1635 has additional information on frost damage to soybeans. The major impact will be the creation of high moisture green soybeans. Frost damaged soybeans also have lower oil and less extractable oil than the average for the area. Greenness is a processing problem; greater refining losses are incurred in removing the green color. Greenness will subside somewhat after several weeks of aeration, which is also necessary to reduce the moisture. Green soybeans will be harder to separate in combines; expect more pods and foreign matter (FM) as well. Moisture meters read low on mixtures of mature and immature beans.

Storage Management

Grains have a shelf life just like any food product. Shelf life is primarily determined by moisture content and temperature. It is gradually used through the time before use, and each operation or storage regime consumes a portion of the life. The table below gives the storage life for corn and soybeans at varying moistures and temperatures. Soybeans respond like corn, but two a percentage point difference in moisture.

Maximum storage time (months) for corn and soybean*							
Corn temperature ° F	Moisture Content Corn *(top %)*, Soybean *(bottom%)*						
	13%, 11%	14%, 12%	15%, 13%	16%, 14%	17%, 15%	18%, 16%	24% N/A
40	150	61	29.0	15.0	9.4	6.1	1.3
50	84	34	16.0	8.9	5.3	3.4	0.5
60	47	19	9.2	5.0	3.0	1.9	0.3
70	26	11	5.2	2.8	1.7	1.1	0.2
80	15	6	2.9	1.6	0.9	0.9	0.06
*Based on 0.5% maximum dry matter loss—calculated on the basis of USDA research at Iowa State University. Corresponds to one grade number loss; 2-3% points in damaged seeds. Soybean approximated at 2% lower moisture than corn.							

Some cautions in using the Table:

1. The numbers assume that temperatures are held constant – such as with aeration. Grain heats when it spoils, and gives off moisture. Unaerated grain will shorten its own shelf life through moisture and heat.

2. Immature soybeans will spoil faster than the Table indicates.

3. If grain is held at higher moisture, then dried, the storage time can be used up in the wet conditions. The dry grain will still experience hot spots or other problems in the summer.

4. Soybeans are difficult to recover once spoilage has started. The oil becomes rancid and oxidizes.

Every action taken after harvest affects the ultimate length of time grain can be stored and the quality at the time of use. Check combine settings between fields because FM and cracked seeds (splits) spoil much faster than whole, sound kernels. Grain that starts to heat or get moldy has essentially used its storage life. The goal of grain storage management is to reduce the rate at which the life is lost. Always get grain cool quickly and minimize variations

Holding wet grain, especially without aeration, shortens shelf life considerably. Overnight storage of wet soybeans in a wagon or truck can have a marked effect on future storability. Always get wet grain into an aerated storage immediately.

Aeration Practice

Phase 1: Fall Cool Down

- Lower grain temperatures in a stepwise fashion
  - October 40-45 F
  - November 35-40 F
  - December 28-35 F

Phase 2: Winter Maintenance

- Maintain temperatures with intermittent aeration
  - January, February 28-35 F

Phase 3: Spring Holding

- Keep cold grain cold
  - Seal fans
  - Ventilate headspace intermittently

The last half of the soybean harvest is likely to be wet (over 14 percent moisture), with many reports of 18-20 percent soybeans. Soybeans dry more easily than corn so air alone, or heat no more than 120F will be adequate. Monitor drying frequently to prevent overdrying. The publication, Soybean Drying and Storage, PM 1636, has additional information. Wet soybeans

should not be held in bunkers, piles, flat storages, sheds or other structures where airflow is not well distributed.

Be selective about what beans are placed in storage versus moved at harvest. Deliberately decide which bins are going to be kept into the summer. Remove the center core and use a grain distributor if possible. Check your grain at least every two weeks, with some way to take grain temperatures. If a slow rise is noted, aerate. If a hot spot starts, move the grain out. It is very difficult to control soybean spoilage once it has started. Oil rancidity becomes a major problem.

Shrink and Soybean Analysis

Higher valued grain and higher moisture have increased the importance of shrink calculations. Regardless of the grain and starting moisture, the water shrink, per percentage point of moisture, will always be 100/(100-target moisture). The market targets are normally 15 percent for corn and 13 percent for soybeans which leads to 1.17 and 1.15 percent shrink per point respectively. Any additional deduction in the market shrink calculation is an allowance for material handling losses. For example, a shrink factor of 1.4 prcent per point gives about 0.22 percent per point for handling loss. Typically a commercial elevator experiences about 1 percent overall handling loss and a good farm system about 0.5 percent overall handling loss. This does not include weight loss from spoilage if grain goes out of condition. Of course, accurate moisture tests are also needed to make shrink calculations work well. Check farm meters on 10-15 samples against the state inspected meter at the local elevator, or the readings from an Official USDA grain inspector (list of locations).

Grain elevators must post their shrink factors as the sum of water plus handling loss. Shrink calculations are important for warehouse receipts, loans, proven yield calculations, and inventory estimates. The general principle is to use a shrink rate that gives a reasonable estimate of the actual grain weight remaining after drying and handling operations. Consider the costs of drying, aeration and storage separately from weight shrink. Recently, shrink factors and price discounts for soybean moisture have increased because of the difficulty created by large amounts of wet soybeans. Producers and elevators alike normally allocate their drying and bins with the best aeration to corn. Large changes in operational strategy are needed to handle wet soybeans. Drying wet soybeans on-farm is likely to be profitable however, when compared to current 2-3 percent shrink/discounts per point.

Wrap-up

Wet soybeans will happen, especially in eastern Iowa. Patience will be important because the grain handling system is also facing a large, wet corn crop in the same areas. Soybeans can be dried with natural air and heated up about 120F; soybeans respond quickly to air conditions. On farm drying is likely to be profitable because the grain market does not have the capacity to handle both wet corn and wet soybeans.

Frost damage occurred in later planted soybeans; the best strategy is to aerate and store for 40-60 days before selling. The greenness may subside enough to be below the color threshold of the Grades. In cases of dispute over grading, submit the sample to a USDA licensed grading agency for resolution. Protein levels are likely to be below average; oil levels above average in Iowa soybeans.

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This article was published originally on 10/19/2009 The information contained within the article may or may not be up to date depending on when you are accessing the information.

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Last Updated 10/19/2009